AD-A143 910

CONNECTICUT RIVER BASIN
BARKHAMSTED, CONNECTICUT

WEST HILL POND DAM

CT. 00377

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

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JANUARY 1979

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West Hill Pond Dam is an earth embankment about 200 ft. long and 10 ft. high, with a crest about 30 ft. wide carrying a local road. West Hill Pond is about 6,500 ft. long and has a surface at normal storage of 246 acres. The dam appears to be in generally good condition. The size classification is thus intermediate and the dam has been classified in the significant hazard potential category.

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:
NEDED

OCT 5 1979

Honorable Ella T. Grasso
Governor of the State of Connecticut
State Capitol
Hartford, Connecticut 06115

Dear Governor Grasso:

Inclosed is a copy of the West Hill Pond Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Environmental Protection, the cooperating agency for the State of Connecticut.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Protection for your cooperation in carrying out this program.

Sincerely,

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

WEST HILL POND DAM

CT 00377

CONNECTICUT RIVER BASIN
BARKHAMSTED, CONNECTICUT

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

Identification No.	CT 00377
Name of Dam:	West Hill Pond Dam
Town:	Barkhamsted
County and State:	Litchfield County, Connecticut
Stream:	Morgan Brook
Date of Inspection:	9 November 1978

BRIEF ASSESSMENT

West Hill Pond Dam is an earth embankment about 200 ft. long and 10 ft. high, with a crest about 30 ft. wide carrying a local road. A combined drop inlet spillway and outlet tower structure in ashlar masonry near the upstream slope is connected to a 3 ft. by 1 ft. 6 in. box culvert under the dam, which carries outflows from both the spillway and an outlet controlled by a slide gate. The spillway is about 3 ft. wide, but the size of the outlet gate is not known. The reservoir is used for recreational purposes and the shores are considerably developed. The water rights are owned by the West Hill Lake Shore Property Owners Association, Inc., but ownership of the dam could not be established.

West Hill Pond is about 6,500 ft. long and has a surface at normal storage of 246 acres. The drainage area is about 742 acres or 1.16 square miles, and the normal storage is 1,640 acre-ft. Maximum storage at top of dam is 2,525 acre-ft.; the size classification is thus intermediate. Because failure might damage some homes, commercial establishments and local roads, the dam has been classified in the significant hazard potential category.

The dam appears to be in a generally good condition. Spillway capacity is too small to handle any flood inflows; floods are accommodated almost entirely by surcharge, which is sufficient to handle 75% of the full PMF test flood volume, if surcharge above spillway level is not encroached upon. The test flood would overtop the dam by about one ft.

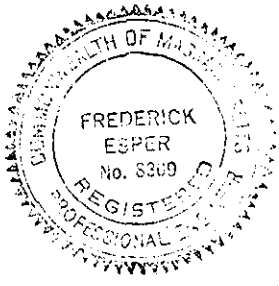
Riprap on the upstream slope in the vicinity of the left abutment has been displaced, causing fairly extensive erosion. There are mature trees growing on both slopes of the embankment and the downstream channel is also considerably overgrown. In the vicinity of the outlet to the culvert under the dam, the channel is clogged with boulders and rocks.

Within two years of receipt of the Phase I Inspection Report, the owner and/or operator of the dam should retain the services of a registered professional engineer to make further investigations, and should implement the results. These studies should cover: (1) whether additional spillway capacity is required; (2) whether the outlet gate is of adequate size and in good repair; (3) provision of a means for removal of floating debris which would be less subject to clogging; (4) whether the masonry outlet culvert under the dam is of adequate size, unobstructed and in good repair; and (5) whether the outlet culvert headwall requires repair.

The owner and/or operator should also implement the following measures: (1) repair the riprap on the upstream slope; (2) remove all brush from the dam embankment and institute a program for selective tree removal; (3) remove rocks, boulders, brush and trees from the downstream channel; (4) remove boards fixed to the spillway trashracks; (5) post the names, addresses and telephone numbers of authorized operators on the gatehouse; (6) institute procedures for a biennial periodic technical inspection; (7) institute procedures for routine maintenance; and (8) develop a formal surveillance, flood warning and emergency evacuation plan.

Peter B. Dyson
Project Manager

Frederick Esper
Vice President



This Phase I Inspection Report on West Hill Pond Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

JOSEPH W. FINEGAN, JR., MEMBER
Water Control Branch
Engineering Division

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

JOSEPH A. MCELROY, CHAIRMAN
Chief, NED Materials Testing Lab.
Foundations & Materials Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

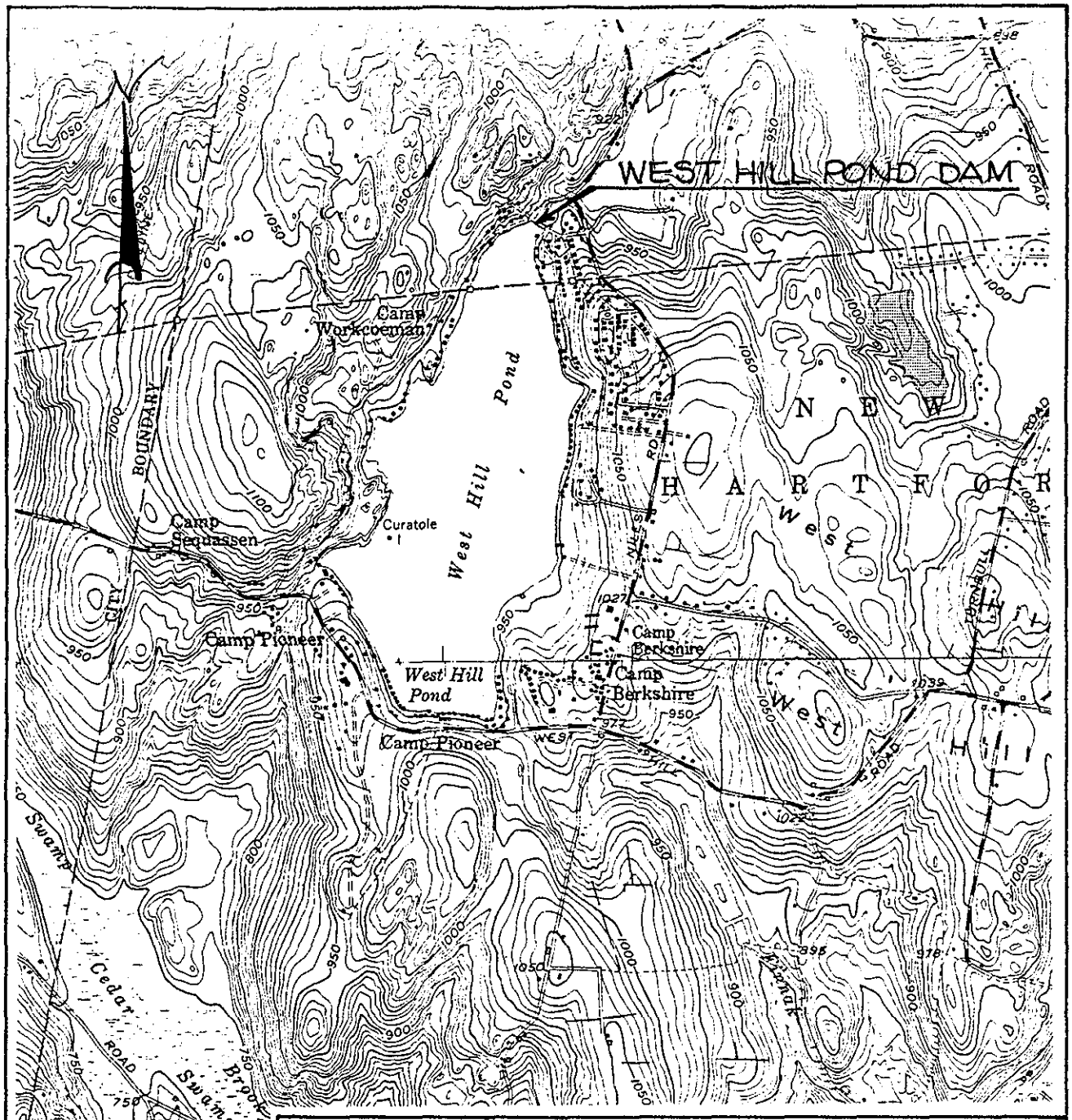
It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

TABLE OF CONTENTS

WEST HILL POND DAM

Overview from left abutment



LOUIS BERGER & ASSOC., INC WELLESLEY, MASS. ARCHITECT · ENGINEER	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

WEST HILL POND DAM

WINSTED & TORRINGTON CT. QUADRANGLES

CONNECTICUT RIVER BASIN STATE - CT

			SCALE 1:24000
			DATE

PHASE I INSPECTION REPORT

WEST HILL POND DAM CT 00377

SECTION 1 - PROJECT INFORMATION

1.1 General

a. Authority

Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Louis Berger & Associates, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Connecticut. Authorization and notice to proceed was issued to Louis Berger & Associates, Inc. under a letter of 27 October 1978 from Max B. Scheider, Colonel, Corps of Engineers. Contract No. DACW33-78-C-0371, Job Change No. 1, has been assigned by the Corps of Engineers for this work.

b. Purpose

1. Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

2. Encourage and assist the States to initiate quickly effective dam safety programs for non-Federal dams.

3. Update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location

West Hill Pond Dam is located in Litchfield County in the town of Barkhamsted in west central Connecticut. Most of the reservoir is in the adjoining town of New Hartford. The site is about 3 miles to the southeast of the city of Winsted and is reached via U.S. Route 44 and West Hill Road. The

pond is natural in origin, being a lake with an average depth of about 25 ft. By construction of the dam, the lake surface level was raised about 9 ft. and the surface area increased from about 205 acres to 246 acres. The dam is operated by the West Hill Lake Shore Property Owners Association, Inc.

b. Description of Dam and Appurtenances

1. Dam

West Hill Pond Dam is a low embankment closing off the outlet channel of an original lake at the headwater of Morgan Brook. The dam is about 10 ft. high and about 200 ft. long, of earth fill construction with a riprapped upstream face. The dam has a crest width of about 30 ft. with steep side slopes. The top of the dam accommodates a paved roadway. The crest of the dam is level for only 86 ft. of its length, rising up to a 2 ft. higher level at each abutment.

Neither the type of material in the embankment nor the nature of the foundation material at the base of the dam is known from available records. A statement in a previous report surmised that the material under the dam is "probably gravel, cobbles and boulders" (Appendix B). It is not known whether there are cutoffs or other foundation treatment details at the base of the dam.

2. Spillway and Outlet Structure

A combined drop inlet spillway and outlet tower structure is located adjacent to the upstream edge of the crest of the dam, near the low point of the valley about 100 ft. right of the left abutment. Upstream ashlar masonry retaining walls at each side of the tower serve to form an inlet channel leading to an outlet gate opening at the bottom of the upstream face of the tower. The size of the gate, which has been described as a "steel plate" type, has not been stated in any correspondence reviewed, and because access to the gatehouse was not possible at the time of the inspection, its size could not be ascertained.

A masonry box culvert under the dam carries outflows from both the drop inlet and the slide gate opening at the outlet tower.

c. Size Classification

West Hill Pond Dam is about 10.5 ft. high above downstream toe level, impounding a maximum of about 1,640 acre-ft. of active storage to spillway crest level, and about 2,500 acre-ft. to top of dam. In accordance with the height and storage capacity criteria given in Recommended Guidelines for Safety Inspection of Dams, storage capacity governs and therefore the project is classified as intermediate in size.

d. Hazard Classification

A breach failure of West Hill Pond Dam would release water down Morgan Brook to its confluence with Mallory Brook about 1.5 miles below the dam, and then down the Mallory Brook channel for another 1.5 miles to the Farmington River. U.S. Highway 44 is located in the Mallory Brook and West Branch Farmington River valleys, and a large flow in this stream would threaten damage to the highway, to traffic traversing it, and to isolated homes and commercial establishments along the highway. In accordance with the Recommended Guidelines for Safety Inspection of Dams, West Hill Pond Dam has therefore been classified as having a significant hazard potential.

e. Ownership

According to an inspection report by A. J. Macchi, Engineers, dated December 3, 1963, the owner of the dam at that time was the Collins Company of Collinsville, Connecticut (Appendix B). Data in the files of the Connecticut Department of Environmental Protection (DEP) record that the water rights to West Hill Pond were then owned by the Collins Company (5/16ths) and the Metropolitan Water District (11/16ths). These water rights were evidently acquired by West Hill Lake Shore Property Owners Association, Inc. about 1964 or 1965, and the dam is now said to be operated by representatives of the Association. No evidence has been obtained, however, that the Association has acquired ownership of the dam; and two of its trustees who were contacted state that the Association does not own it. It is understood that the Collins Company has either moved out of Connecticut or no longer exists as a business entity.

The Office of Assessors, Town of Barkhamsted, confirmed that it does not have a recorded owner for the dam and that no property taxes are being paid on that parcel of land. Legal ownership of West Hill Pond Dam therefore appears to be in doubt, but it is beyond the scope of this Phase I Inspection to make a determination on this matter.

The two trustees of West Hill Lake Shore Property Owners Association, Inc. who were contacted are:

Mr. Kenneth Payne	Mr. Donald J. Veiring
61 Cleveland Street Ext.	35 Atwater Road
Plainville, CT 06062	Collinsville, CT
Telephone: (203) 747-1778	Telephone: (203) 693-4756

According to Mr. Payne and Mr. Veiring, the Association consists of 8 or 10 other associations of property owners around West Hill Pond, primarily Boy Scout and other summer camps. They confirmed that the Association has purchased the water rights but does not own the dam. The Association does maintain the outlet structure, however, and adjusts the reservoir water level to suit its members' needs, according to these trustees.

f. Operator

According to trustees of the West Hill Lake Shore Property Owners Association, Inc., the outlet works are operated and maintained by the Superintendent of Camp Sequassen, Mr. Ernest Wheat, who lives in Winsted, CT.

According to information obtained from other sources since the inspection, but not verified, the following persons operate the outlet gate:

Mr. William J. McNamara	Mr. James F. Meyers
Niles Road	105 Essex Avenue
New Hartford, CT	Waterbury, CT 06714
Telephone: (203) 379-8677	Telephone: (203) 756-8698

g. Purpose of Dam

The West Hill Pond Reservoir is primarily a recreation lake with many homes and Boy Scout camps occupying the shoreline and adjoining areas. Correspondence reviewed mentioned riparian water rights along the streams downstream from the reservoir, but it is not known whether such rights are still in effect or whether they are now vested in the West Hill Lake Shore Property Owners Association.

h. Design and Construction History

It is not known by whom the dam was designed or constructed; no drawings or reports have been found. The outlet tower and culvert are of ashlar masonry, which has been out of vogue as a construction material since the turn of the century. This would tend to date the construction as being in the 19th or very early 20th century.

i. Normal Operating Procedure

The dam appears to be operated by various representatives of the West Hill Lake Shore Property Owners Association on an ad hoc basis to suit the needs of its members.

1.3 Pertinent Data

a. Drainage Area

The drainage area contributing to the West Hill Pond Reservoir is situated at the headwater of Morgan Brook. The pond is natural in origin and said to receive its major source of inflow from bottom springs and two small brooks. The drainage area encompasses a total of about 742 acres, of which about 246 acres are occupied by the lake. The longest circuitous stream course contributing to the lake is about 5,000 ft. long with an elevation difference of about 132 ft., or at a slope of about 139 ft. per mile. The drainage area has a length of about 1.5 miles and a maximum width of about 1.1 miles, with an average width of about 0.75 miles. The basin rim on the east side of the lake is a maximum of about 1,500 ft. from the lake shore; on the west side, the basin rim is a maximum of about 3,000 ft. from the shore.

b. Discharge at Damsite

1. Outlet Works

All discharges from West Hill Pond Lake must be released through the outlet culvert and drop inlet spillway. As noted on Sheet D-1, Appendix D, the outlet gate when fully open together with the drop inlet weir can accommodate a release of about 60 cfs. with reservoir to top of dam. The spillway can release about 17 cfs. at that same head if the outlet gate is closed. Discharge curves and computations are shown on Sheets D-1 thru D-3, Appendix D.

2. Maximum Known Flood at Dam

There are no known records of flood inflows into the reservoir, nor are there records of surcharge encroachment of outflows during major inflows. Since the capacity of the drop inlet spillway is small and the outlet gate is generally only fractionally open, all flood inflows would have to be absorbed by surcharge storage. With no records available of lake level fluctuations, it would be difficult to relate the inflows to surcharge storages.

c. Elevation (ft. above MSL)

1. Top of dam - 941.5
2. Maximum pool - 941.5
3. Spillway crest - 938
4. Diversion invert - 930.8
5. Streambed at centerline of dam - 930.8

d. Reservoir

1. Length of pool at top of dam - 6,500 ft.
2. Length of pool at normal storage - 6,400 ft.
3. Average width of pool - 1,675 ft.

e. Storage (acre-ft.)

1. At normal storage pool (active) - 1,640
2. At top of dam - 2,525

f. Reservoir Surface (acres)

1. At top of dam - 260
2. At spillway crest - 246
3. At invert of outlet culvert - 207

g. Dam

1. Type - Earthfill
2. Length - 200 ft.
3. Height - 10.7 ft.
4. Top width - 30 ft. ±
5. Side slopes - 2 to 1 upstream; irregular downstream
6. Zoning - Unknown
7. Impervious core - Unknown
8. Cutoff - Unknown
9. Grout curtain - None (assumed)

h. Spillway

1. Type - Drop inlet
2. Length of weir - 3 ft.
3. Crest elevation - 938 MSL
4. Ungated
5. Upstream channel - None
6. Downstream channel - 3 ft. x 1.5 ft. culvert
7. General - Drop inlet flow control is at weir with culvert at part full flow. For outlet gate, full open control is at outlet end of culvert.

i. Regulating Outlet

1. Invert - Elev. 930.8
2. Size - 3 ft. wide by 18 in. high culvert
3. Description - Outlet gate through wall of drop inlet spillway. Common culvert under dam for spillway and outlet discharges.
4. Control mechanism - Outlet gate at outer wall of drop inlet spillway well. Steel plate slide gate, size undetermined.

SECTION 2 - ENGINEERING DATA

2.1 Design

No drawings or design data are available. A layout sketch prepared from measurements made at the time of this inspection is shown as Figure 2, Sheet D-4, in Appendix D.

2.2 Construction

No records or histories of construction of the dam have been found. It is not known when or by whom the dam was built.

2.3 Operation

Operation of the dam appears to be on an informal, ad hoc basis and no operation data has been recovered.

2.4 Evaluation

a. Availability

Since no engineering data is available, it is not possible to make an assessment of the safety of the embankment. The basis for the information presented in this report is principally the visual observations of the inspection team.

b. Adequacy

Without any engineering data, a definitive review and assessment of this dam is not possible.

c. Validity

Not applicable.

SECTION 3 - VISUAL INSPECTION

3.1 Findings

a. General

The visual inspection of West Hill Pond Dam took place on 9 November 1978. The dam appears to be in a generally good condition. The riprap on the upstream slope in the vicinity of the left abutment is displaced, causing fairly severe erosion. Mature trees are growing on the dam embankment and the downstream channel is overgrown. In the vicinity of the outlet to the box culvert under the dam, the channel is partially blocked with rocks and boulders.

The reservoir was at a level about 18 in. below the spillway crest. The gatehouse over the drop inlet spillway and outlet tower was locked and a detailed inspection of the outlet gate and hoisting mechanism could not be made. Efforts to identify the owner and/or operator of the dam before the date of inspection were unsuccessful, and it proved impossible to locate a key at that time.

b. Dam

The dam is essentially a highway embankment of earth and stone closing off the outlet of the lake. The dam is about 200 ft. long and 10 ft. high, with a 30 ft. wide paved roadway (Appendix C, Photo No. 1). It is surmised that the original dam had a narrower top width and that it was widened downstream at some later time to accommodate the roadway.

The upstream slope is riprapped with massive rock which, however, has not been sufficiently well placed in the left abutment area to prevent fairly severe erosion. A seawall protects the right abutment, together with some supplemental protection offered by a small beach and a sand boat ramp. The asphalt curbing on the upstream side of the roadway deflects surface drainage from the upstream slope. Trees up to 6 in. dia. are well established on both slopes of the dam. The downstream slope is irregular.

The dam is in generally good condition, with some moderate maintenance being required, particularly control of overgrowth and riprap realignment.

c. Appurtenant Structures

Because the outlet tower house was locked, only a cursory inspection of the appurtenant facilities at the dam was possible. Structure details as described in a December 3, 1963, inspection report by A. J. Macchi, Engineers, (Appendix B) were reviewed for reference and verified wherever visible. The layout sketch included as Figure 2, Sheet D-4, Appendix D, was prepared on the basis of measurements and examinations which were made during this inspection.

The drop inlet well is about 3 ft. square, with the front wall carried to elevation 938, or about 3.5 ft. below the top of the dam. The weir formed by the top of this wall is about 3 ft. in length. A wooden bar trashrack of about 1 in. square wood strips spaced at about 2 in. centers covers the spillway crest opening, and these were partly covered with boards at the time of the inspection, presumably to permit storing of lake waters to a higher level than the spillway crest. It is not known whether these boards are in place permanently or are only a temporary expedient. Correspondence in CT. DEP files dated August 1968 noted that the outlet gate and frame were deteriorating and in need of repair (Appendix B). It is not known whether this work was carried out, as no subsequent records have been found.

A masonry box culvert 3 ft. wide by 1.5 ft. high placed at natural ground level under the dam leads from the base of the tower to an ashlar masonry gravity headwall at the downstream toe of the dam. The headwall is in fair condition, but some incipient raveling is becoming evident (Appendix C, Photo No. 3). The invert of this culvert is about 10.5 ft. below the crest of the dam. The culvert discharges directly into the downstream Morgan Brook channel, which at the time of the inspection was filled with rocks and stones so as to almost submerge the downstream exit of the culvert (Appendix C, Photo Nos. 3 & 4). The length of the culvert measured from the tower to the downstream outlet is about 30 ft. About 300 ft. below the dam, Morgan Brook is carried under a local road via a 36 in. dia. pipe (Appendix C, Photo No. 2).

d. Reservoir Area

West Hill Pond shoreline is heavily occupied with homes and Boy Scout Camp buildings. The shores of the pond are stable, and are of natural forestation, artificial beach, or well-maintained private sea walls for seasonal residences. From

the USGS quadrangle maps, many of these buildings are seen to be at or lower than the elevation 940 contour, or within the surcharge freeboard of the reservoir. In the event of a large storm runoff sufficient to fill the surcharge space and threaten an overtopping of the dam, these houses could be partially inundated.

As discussed in Section 5, the ratio of drainage area to reservoir area is about 3 to 1. Because of the small spillway capacity, most of the runoff volume of a flood event will be captured in the surcharge storage space, so that for each inch of rainfall a reservoir rise of about 3 in. will result. Tabulated below is a demonstration of the approximate rainfall-surcharge relationship:

Storm Magnitude	Runoff (rainfall) in inches	Reservoir Rise - ft.	Remaining Freeboard to Top of Dam - ft.
No runoff	0	0	3.5
0.25 PMF	6*	1.5	2.0
0.5 PMF	12	3.0	0.5
PMF	24	6.0	Dam overtopped

*Assumed to be about 100 year frequency precipitation

It will be noted that the above conditions assume the reservoir to be at the level of the spillway crest at the start of the flood event. If the reservoir is maintained at a higher level by blocking the spillway openings above the spillway crest level, less surcharge storage space will be available to accommodate the inflow volume of a storm; consequently, the surcharge freeboard will be lessened and the dam will be overtopped by a storm of lesser magnitude than indicated above.

e. Downstream Channel

Heavy growth has invaded the rather poorly defined downstream channel, which is to some extent also obstructed by random boulders immediately below the dam. Conditions along the Morgan Brook and Mallory Brook are discussed in Section 1.2d.

In the event of a breach in West Hill Pond Dam, as much as 2,500 acre-ft. of active storage could be released from the reservoir. Depending on the width of the breach, a flood wave of up to 4,000 cfs. could issue from the dam. The valleys through which the brooks traverse are quite narrow with steep gradients, such that valley storage would not

be large. Assuming an average valley width of about 300 ft. for a 10 ft. flow depth, the 3 miles of Morgan and Mallory Brooks would absorb about 500 acre-ft., leaving 2,000 acre-ft. to be stored in the West Branch Farmington River. The flood wave could extend through New Hartford and Pine Meadow, and well beyond the town of Collinsville.

3.2 Evaluation

The visual inspection of West Hill Pond Dam has adequately revealed key characteristics of the dam as they relate to stability and integrity.

The spillway is very small in relation to the runoff potential from the drainage area of more than a square mile, so that flood inflows must be handled mainly by surcharge storage rather than by outflow capacity. Encroachment on normal surcharge capacity by blocking the spillway crest reduces the capability of the reservoir to handle larger magnitude floods. The practice of boarding off the spillway crest opening should therefore be terminated. The closely spaced trashrack bars could easily become clogged with debris, and a wider spaced trashrack or floating trash boom should be utilized instead.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures

Representatives of the West Hill Lake Shore Property Owners Association operate the dam on an informal, ad hoc basis. There appear to be no formal operating procedures.

4.2 Maintenance of Dam

Trustees of the West Hill Lake Shore Property Owners Association state that the dam is not owned by the Association and is not maintained by the Association. Legal ownership of the dam has not been established during the Phase I Inspection, and it appears that it is not being maintained by anyone.

4.3 Maintenance of Operating Facilities

According to trustees of the Association, the Association maintains the outlet structure and slide gate. It was not possible to check the operation of the slide gate during the inspection.

4.4 Warning System

As far as can be ascertained, there is no formal surveillance and warning program at this dam.

4.5 Evaluation

A formal plan for operation of the dam is needed. Ownership of the dam should be established and who is responsible for maintenance determined. A plan for routine maintenance should then be developed. A formal surveillance and flood warning plan and procedures should also be developed. The names, addresses and telephone numbers of persons with access to the gatehouse and responsible for operating the outlets should be prominently posted on the gatehouse.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data

1. Reservoir Areas and Capacities

For determining reservoir areas and capacities below normal storage level, a contour map (Fig. 3, Sheet D-5, Appendix D) prepared by the State of Connecticut Department of Environmental Protection showing lake soundings was planimetered and capacities were computed. For determining surface areas and surcharge capacities, planimetered areas were taken from contours delineated on USGS 2,000 ft. per in. quadrangle sheets. Area and capacity curves and tables, for use in flood routings, are shown on Sheets D-6 and D-7, Appendix D.

2. Flood Hydrology

Hydrologic characteristics of West Hill Pond Dam and its drainage area were evaluated in accordance with criteria given in Recommended Guidelines for Safety Inspection of Dams. As indicated in Section 1.2, paragraphs c and d, West Hill Pond Dam is accorded an intermediate size classification with a significant hazard potential rating. The recommended range of test floods for hydraulic evaluation of such a dam is between ½ PMF and PMF. Although failure of the dam would produce a downstream river flood stage not exceeding about 7 ft., because normal reservoir storage is large in relation to storage capacity of downstream valleys, the risk of damage to downstream interests would extend for the entire stream length of the Morgan and Mallory Brooks. The full PMF was therefore selected as appropriate for evaluation of the adequacy of the dam.

Precipitation data were obtained from Hydrometeorological Report No. 33, which for the Connecticut area approximates 24.3 in. of 6-hour point rainfall over a 10 square mile area. This value was then reduced by 20 percent to allow for basin size, shape and fit factors. The 6-hour rainfall duration curve of a total of 19.2 in. was then distributed and rearranged as suggested in Design of Small Dams. A constant loss factor of 0.1 in. per hour was deducted from the precipitation values to give the excess rainfall used to prepare an inflow hydrograph.

Since the reservoir area comprises one-third of the total drainage area, the precipitation on the lake was separated from that on the overland portion. For the lake itself, the precipitation was assumed as instantaneous runoff, with rectangular incremental hydrographs. For the overland runoff, a triangular incremental hydrograph was assumed, using a computed lag time value of about 0.48 hours to derive a time-to-peak for the triangular hydrograph of 0.5 hours (see computations on Sheet D-8 to D-10, Appendix D). A PMF inflow hydrograph is shown on Figure 5, Sheet D-11, indicating a peak inflow of about 6,800 cfs. or a CSM of about 5,850.

Routing the combined PMF inflow hydrograph through the reservoir and spillway results in a maximum surcharge to elevation 942.5, which would overtop the dam by one ft.

Routing a 0.75 PMF results in a maximum surcharge to elevation 941.43, just short of an overtopping. A graphic flood routing of these floods is shown on Figure 6, Sheet D-12, Appendix D.

b. Experience Data

No records have been found in regard to past operation of the reservoir, or of surcharge encroachments and spills through the spillway or outlet gate. The maximum past inflows are unknown.

c. Visual Observations

There are no present evidences either along the shores of the reservoir or in the downstream channel to indicate high water levels or whether the dam has ever been overtopped. No one contacted could recollect any flooding incidents.

d. Overtopping Potential

For the selected full PMF test flood, an overtopping of up to one ft. over the dam would occur. For a flood of 0.75 PMF or less, no overtopping would occur. It should be noted, however, that the practice of covering the lower part of the trashrack above the spillway inlet with boards, presumably to create a higher reservoir level, could drastically reduce the project's capacity to handle flood events of less than 0.75 PMF.

e. Drawdown Capacity

Drawdown of the reservoir is possible through the outlet gate, assuming that it is in working order and can be opened wide. For evacuating the active storage capacity in the reservoir to the top of the outlet culvert, an average release of about 40 cfs. could be discharged. On this basis a period of about 20 days would be required to release the 1,640 acre-ft. in the reservoir, assuming no inflows in the interim. If the storage level was at or above normal, to lower the reservoir level 1 ft. would require about 2.5 days. If it is assumed that warning of a large storm being imminent would be only a day or less, the reservoir could not be drawn down sufficiently in anticipation of a large inflow to be effective in reducing surcharge encroachment.

f. Downstream Hazard

In the event of a breach in the dam either from an overtopping or from piping or sloughing, an outflow of about 4,000 cfs. could be released from the reservoir, based on a breach failure about 80 ft. wide. With a stream slope of about 210 ft. per mile downstream from the dam, it is estimated that a flood wave with a flow depth of about 7 ft. would prevail in the approximately 150 ft. wide valley channel. The local road about 300 ft. downstream from the dam would be overtopped. Because of small valley storage, this 7 ft. stage would prevail for about 3 miles down Morgan and Mallory Brooks, with some lower stage in the West Branch Farmington River, as far as Collinsville and beyond (see Section 3.1e). The effect on life and property for the entire reach of river has not been evaluated in detail, but it is reasoned that some loss of life and appreciable economic losses would be likely to occur. Delineated on the USGS guadrangle sheet (Figure 7, Sheet D-13, Appendix D) is the approximate extent of the river valley which will be affected.

SECTION 6 - STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observation

The field investigations of the embankment revealed no significant displacement or distress which would warrant the preparation of slope stability computations based on assumed soil properties and engineering factors.

b. Design and Construction Data

No original data is available on the design or construction of the dam. An inspection of the dam was made by A. J. Macchi, Engineers, who reported to the State Water Resources Commission on December 3, 1963 (Appendix B). This report concluded that the dam was then safe and did not require repairs. The 1963 report contains the only known representation of the dam, being a schematic plan and section to scale of 1-in. to 20-ft.

A subsequent inspection was made in 1968 by State Water Resources Commission officials after a diver, engaged to remove an obstructing log from the gate, had noted deterioration of the gate framework. Further, the downstream end of the stone box culvert was then almost completely covered with dislodged rocks. It is not known whether any action was taken to remedy these deficiencies.

c. Operating Records

No formal records are known to exist. The dam has been monitored periodically by the Connecticut Department of Environmental Protection, Water Resources Commission.

d. Post Construction Changes

There have been no known post-construction changes which would adversely affect the dam stability or structural integrity.

e. Seismic Stability

The dam is located in Seismic Zone No. 1, and in accordance with Phase I guidelines, does not warrant seismic analysis.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS & REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition

On the basis of the Phase I visual examination, West Hill Pond Dam appears to be in good condition. The deficiencies revealed are not of major concern, but tend to indicate that maintenance has been neglected and operational procedures are unsatisfactory. The surcharge capacity is only sufficient to accommodate 75% of the test flood without overtopping the dam. The spillway capacity is negligible and floods are handled entirely by surcharge storage.

Massive rock riprap on the upstream slope in the left abutment area is displaced, causing fairly severe erosion of the upstream slope in this vicinity. Trees up to 6 in. dia. are well established on both slopes of the dam. The downstream channel is overgrown and partially clogged with rocks and boulders, almost to the top of the outlet culvert. This condition was reported as existing in August 1968 (Appendix B).

The practice of using boards attached to the spillway trashracks for the apparent purpose of maintaining a reservoir level higher than the sill of the spillway is dangerous. This procedure restricts the ability of the surcharge storage space to handle large inflow volumes and increases the threat of inundation to the shore residents in the event of such surcharge encroachment.

1968 correspondence noted that the outlet gate and frame were deteriorating and in need of repair or replacement (Appendix B). It has not been determined whether this work was carried out.

b. Adequacy of Information

Since no engineering data or records have been recovered, the information available must be considered inadequate. Assessment of the performance of the dam has therefore been based solely on visual observations and engineering judgment.

c. Urgency

The dam appears to be in no immediate danger of becoming a hazard to life and property. The recommendations and remedial measures enumerated below should be implemented by the owner and/or operator within two years after receipt of this Phase I Inspection Report.

d. Need for Additional Investigation

Additional investigations are required as recommended in Para. 7.2.

7.2 Recommendations

It is recommended that the owner and/or operator of West Hill Pond Dam should retain the services of a competent registered professional engineer to make investigations and studies of the following items, and, if proved necessary, design appropriate remedial works:

1. Determine whether additional spillway capacity is required.

2. Determine whether the existing outlet gate is of adequate size and in good repair.

3. Provide a means for removal of floating debris which is less subject to clogging and does not restrict spillway discharges.

4. Determine whether the masonry outlet culvert under the dam is of adequate size, unobstructed and in good repair.

5. Determine whether the outlet culvert headwall requires repair.

7.3 Remedial Measures

The owner and/or operator should take the following actions:

1. Repair the riprap on the upstream slope in the vicinity of the left abutment.

2. Remove all brush growing on the dam embankment. Adopt a program of selective tree removal, beginning with those on the upstream face. Where feasible, stumps should be removed and the holes filled with a well compacted fill material. In appropriate cases, stump removal may be delayed for a number of years.

3. Remove rocks and boulders from the downstream channel and clear all brush and tree growth from the channel.

4. Remove boards fixed to the spillway trashracks.

5. Post on the gatehouse the names, addresses and telephone numbers of all individuals with access to the gatehouse and authority to operate the outlet facilities.

a. Operation and Maintenance Procedures

The owner and/or operator should institute procedures for a biennial periodic technical inspection of the dam and appurtenant works, with supplementary inspections for any suspect items. A checklist for periodic inspections should be developed and records should be kept of all maintenance and repair work performed. Ordinary maintenance, such as cutting brush and repairing riprap, should be carried out in accordance with a regular and consistent program. A formal surveillance, flood warning and emergency evacuation plan should also be developed.

7.4 Alternatives

The only appropriate alternatives to these recommendations appear to be: (1) raising the dam; (2) maintaining the reservoir at a lower pool elevation; and (3) breaching the dam.

APPENDIX A

VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION
PHASE I

Identification No.: CT 00377 Name of Dam: West Hill Pond

Date of Inspection: 9 November 1978

Weather: Clear Temperature: 60°F ±

Pool Elevation at Time of Inspection: 936.5

Tailwater Elevation at Time of Inspection: 931.0

INSPECTION PERSONNEL

Pasquale E. Corsetti	Louis Berger & Associates, Inc.	Acting Proj. Manager
Carl J. Hoffman	Louis Berger & Associates, Inc.	Hydraulics, Structures
Thomas C. Chapter	Louis Berger & Associates, Inc.	Hydrology, Soils
James H. Reynolds	Goldberg Zoino Dunnicliff & Associates, Inc.	Soils

OWNER'S REPRESENTATIVE

None

STATE REPRESENTATIVE

Victor J. Galgowski	Department of Environmental Protection Water & Related Resources Unit	Superintendent of Dam Maintenance

VISUAL INSPECTION CHECK LIST

Identification No. CT 00377 | Name of Dam: West Hill Pond | Sheet 1

VISUAL EXAMINATION OF	OBSERVATIONS AND REMARKS
EMBANKMENT Vertical alignment and movement	No movement evident.
Horizontal alignment and movement	No movement evident.
Unusual movement or cracking at or near the toe	None evident.
Surface cracks	None evident.
Animal burrows and tree growth	Mature trees established on d/s slope, in d/s channel, and on u/s slope above riprap.
Sloughing or erosion of slopes	Somewhat severe erosion, upstream side above riprap at left abutment.
Riprap slope protection	Erratically placed locally in vicinity of left abutment.

VISUAL INSPECTION CHECKLIST

Identification No. CT 00377 | Name of Dam: West Hill Pond | Sheet 2

VISUAL EXAMINATION OF	OBSERVATIONS AND REMARKS
Seepage	None evident.
Piping or boils	None evident.
Junction of embankment and abutment, spillway and dam	No problems evident.
Foundation drainage	None.
OUTLET WORKS Approach channel	None.
Outlet conduit concrete surfaces	Ashlar masonry in fair condition with masonry headwall.
Intake structure	Ashlar masonry tower incorporating slide gate and spillway.
Outlet structure	3'-0" wide x 1'-6" high ashlar masonry box culvert.

VISUAL INSPECTION CHECKLIST

Identification No. CT 00377 | Name of Dam: West Hill Pond | Sheet 3

VISUAL EXAMINATION OF	OBSERVATIONS AND REMARKS
Outlet channel	Natural stream full of boulders almost to soffit of box culvert.
Drawdown facilities	Slide gate of unknown size and condition.
SPILLWAY STRUCTURES Concrete weir	3 ft. long weir on front wall of outlet tower (masonry).
Approach channel	None.
Discharge channel	See "Outlet Works" above.
Stilling basin	None.
Bridge and piers	None.
Control gates and operating machinery	None.

VISUAL INSPECTION CHECKLIST

Identification No. CT 00377 | Name of Dam: West Hill Pond | Sheet 4

VISUAL EXAMINATION OF	OBSERVATIONS AND REMARKS
INSTRUMENTATION Headwater and tailwater gages	None.
Embankment instrumentation	None.
Other instrumentation	None.
RESERVOIR Shoreline	Gentle slopes, wooded, stable, heavily populated by homes and summer camps (Scouts, etc.)
Sedimentation	None evident.
Upstream hazard areas in event of backflooding	Homes and camp buildings at low elevations within surcharge storage & close to shoreline.
Alterations to watershed affecting runoff	No recent alterations noted.

VISUAL INSPECTION CHECKLIST

Identification No. CT 00377 | Name of Dam: West Hill Pond | Sheet 5

VISUAL EXAMINATION OF	OBSERVATIONS AND REMARKS
DOWNSTREAM CHANNEL Constraints on operation of dam	None - 3 ft. x 1.5 ft. culvert controls outflow.
Valley section	Narrow, wooded.
Slopes	Steep.
Approx. No. of homes/population	5 homes in first ½ mi. Morgan Brook, 5-10 homes/mile along Mallory Brook & Farmington River, some commercial establishments.
OPERATION & MAINTENANCE FEATURES Reservoir regulation plan, normal conditions	No formal plan. Lake regulated to suit requirements of lakeshore owners by representatives of owners association which owns water rights.
Reservoir regulation plan, emergency conditions	None.
Maintenance features	No maintenance to dam (owner uncertain). May be some maintenance to outlet structure.

APPENDIX B

RECORDS & PAST INSPECTION REPORTS

J. M A C C H I • E N G I N E E R S

GIULIO PIZZETTI — ASSOCIATE CONSULTANT

ILLETT STREET — HARTFORD, CONN. — PHONE 525-6631
IRSO DUCA ABRUZZI — TORINO, ITALY — PHONE 519-473

E. — A.S.C.E. — A.C.I.

December 3, 1963

STATE WATER RESOURCES COMMISSION
RECEIVED
DEC 5 1963
ANSWERED
REFERRED
FILED

Water Resources Commission
State of Connecticut
165 Capitol Avenue
Hartford, Connecticut

Attention Mr. Wm. Sander

Re: West Hill Pond Dam
Barkhamsted, Connecticut

Gentlemen:

Enclosed is report for the above-referenced project as requested in your letter of November 26, 1963.

Very truly yours,

A. J. MACCHI, ENGINEERS

I. R. Skoglund

I. R. SKOGLUND, P. E.

Encl.

STATE WATER RESOURCES COMMISSION
RECEIVED
DEC 5 1963
ANSWERED
REFERRED
FILED

REPORT ON WEST HILL POND DAM
BARKHAMSTED, CONNECTICUT

BY
A. J. MACCHI, ENGINEERS
HARTFORD, CONNECTICUT

DECEMBER 3, 1963

---

1. IDENTIFICATION

   A. An inspection of the above dam was made on November 29, 1963 as requested in a letter from the Water Resources Commission dated November 26, 1963.

   B. The dam is known as West Hill Pond Dam.

   C. The dam is located in the U.S.G.S. Winsted Quadrangle map at Coordinates N41°-53' & E73°-02'.

   D. Owner of the dam is Collins Company, Collinsville, Conn.

   E. Not known by this office.

2. FACTORS OF HAZARD

   A., B., & C., Not applicable in this report.

3. STRUCTURE

   A. The dam is constructed of stone and earth fill. The top is a paved road ~~30'~~ wide with 2:1 side slopes and about ~~200' long~~.

   B. The foundation material under the dam is probably gravel, cobbles and boulders.

   C. The ~~spillway~~ is a ~~3' x 3'~~ vertical opening in the upstream stone face, its crest is about 4'-0" below the top of the dam. This spillway drops into a ~~3'-0" W. x 4'-6" H.~~ stone box culvert the upstream invert of which is about ~~10'~~ below the top of the dam and has a drawdown gate valve at the upstream inlet.

   D. The ~~freeboard~~ above the spillway crest is about 4'-0".

   E. At this inspection there was no evidence of seepage or scour at the dam. The lake water level has been drawn down to the bottom of the dam at this inspection.

4. HYDROLOGY

A. The ~~net drainage area~~ is ~~850 acres~~.

B. The ~~100 year storm~~ flow by ~~Izzard method~~ is approximately ~~500 C.F.S.~~

C. The ~~maximum~~ spillway capacity is about ~~90 C.F.S.~~ at Head = 9'.

D. The 100 year storm runoff would exceed the computed spillway capacity, however, since the lake area ~~(260 Ac.)~~ is large it would in my estimation provide adequate storage capacity to accommodate the spillway surcharge. As an example, 1' rise in lake elevation is equivalent to about 10 M. C.F. of water.

5. SAFETY

A. No.

B. Not applicable in this report.

C. " " " " "

D. No.

6. REQUIREMENTS

At this inspection the dam would not require any repairs.

7. SUMMARY OF FACTS

West Hill Pond Dam located in Barkhamsted, Connecticut is a stone and earth fill dam. The stone culvert is provided with a gate for drawing down the lake, which at this inspection has been done. Although the 100 year storm runoff would exceed the spillway capacity, the large lake area provides substantial storage capacity to absorb this surcharge.

8. CONCLUSION

In my opinion the dam is safe at the present time and would not require repairs.

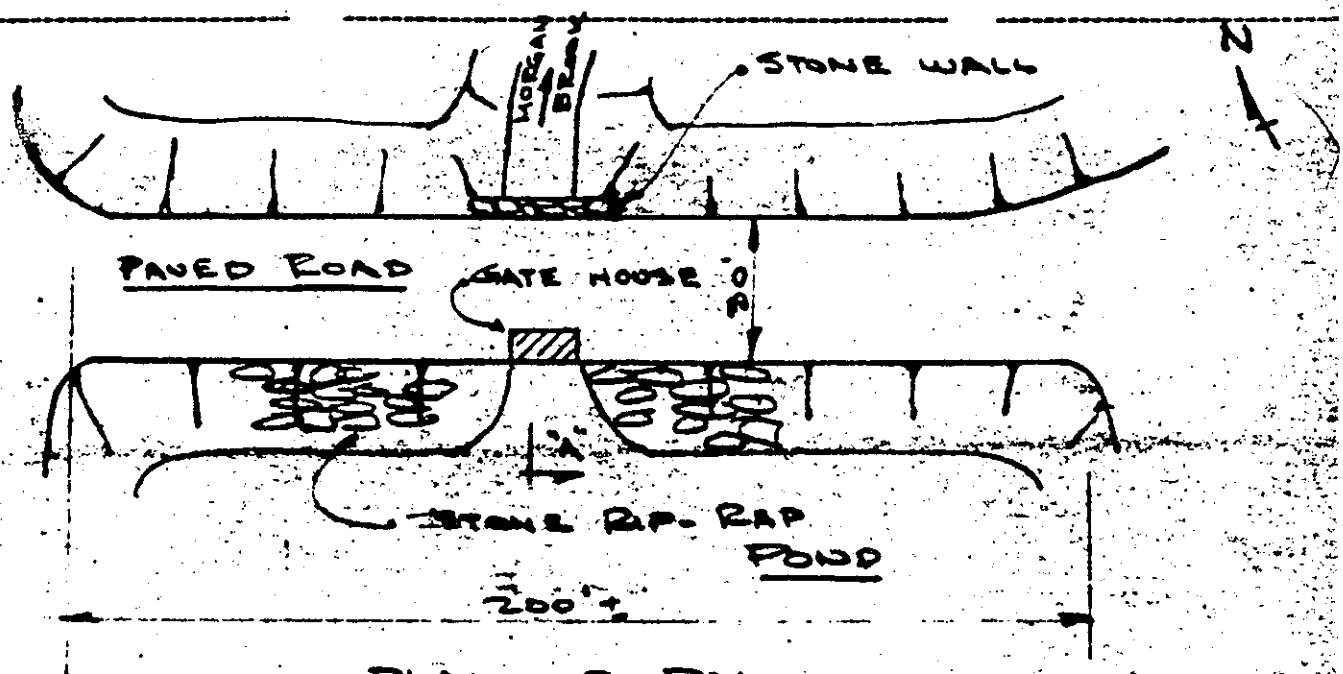
9. RECOMMENDATION

Not applicable in this report.

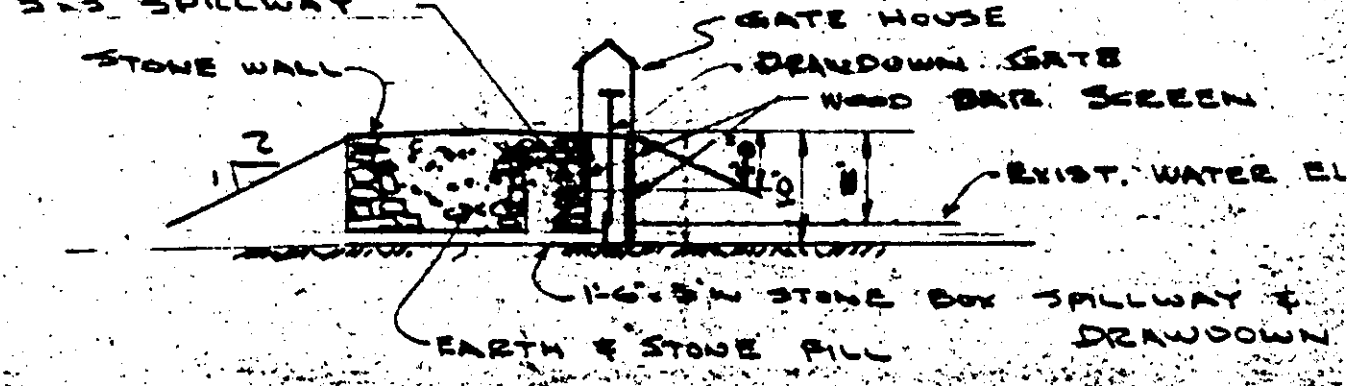
APPENDIX

See Attached Sheets.

BY ICS DATE 11/29/63 SUBJECT WEST HILL POND DAM SHEET NO. 1 OF
CHKD. BY DATE PARKHAMSTED, CONN. JOB NO.



PLAN OF DAM
1" = 40'



SECTION "A" THRU DAM
1" = 20'

August 7, 1968

Mr. Donald J. Viering
35 Atwater Road
Collinsville, Connecticut

Subj: West Hill Lake Dam
Barkhamsted

Dear Mr. Viering:

After our luncheon meeting on July 31, 1968, Mr. Charles J. Pelletier, Division Engineer of this office, and myself met Mr. Wheat at the subject dam.

From our brief inspection inside the gatehouse and from talking to Mr. Wheat, it appeared that additonal steps should be taken to determine what parts of the gate or framework should be repaired or replaced. The downstream end of the outlet culvert was almost completely buried under stones and should be cleared. A determination of the stability of the downstream end-wall should be made to see if these stones have fallen from there.

To accomplish the repair work, the lake would have to be drained or a cofferdam constructed. There was what appeared to be a stone wall upstream of the gate, against which a cofferdam might be constructed. Possibly a combination of lowering the pond somewhat and the construction of a cofferdam may be the most economical and practical method. We would advise you to obtain the services of an engineer registered in the State of Connecticut and familar with such work, to evaluate the problem and come up with a solution.

If you or he feel that the services of a diver would be helpful, the following company is in this business and might be of help:

Marine Contracting Inc.
3280 Post Road
Southport, Connecticut Tel: 259-5204

We would appreciate a copy of any engineering study and would like to be kept informed of your progress.

Very truly yours,

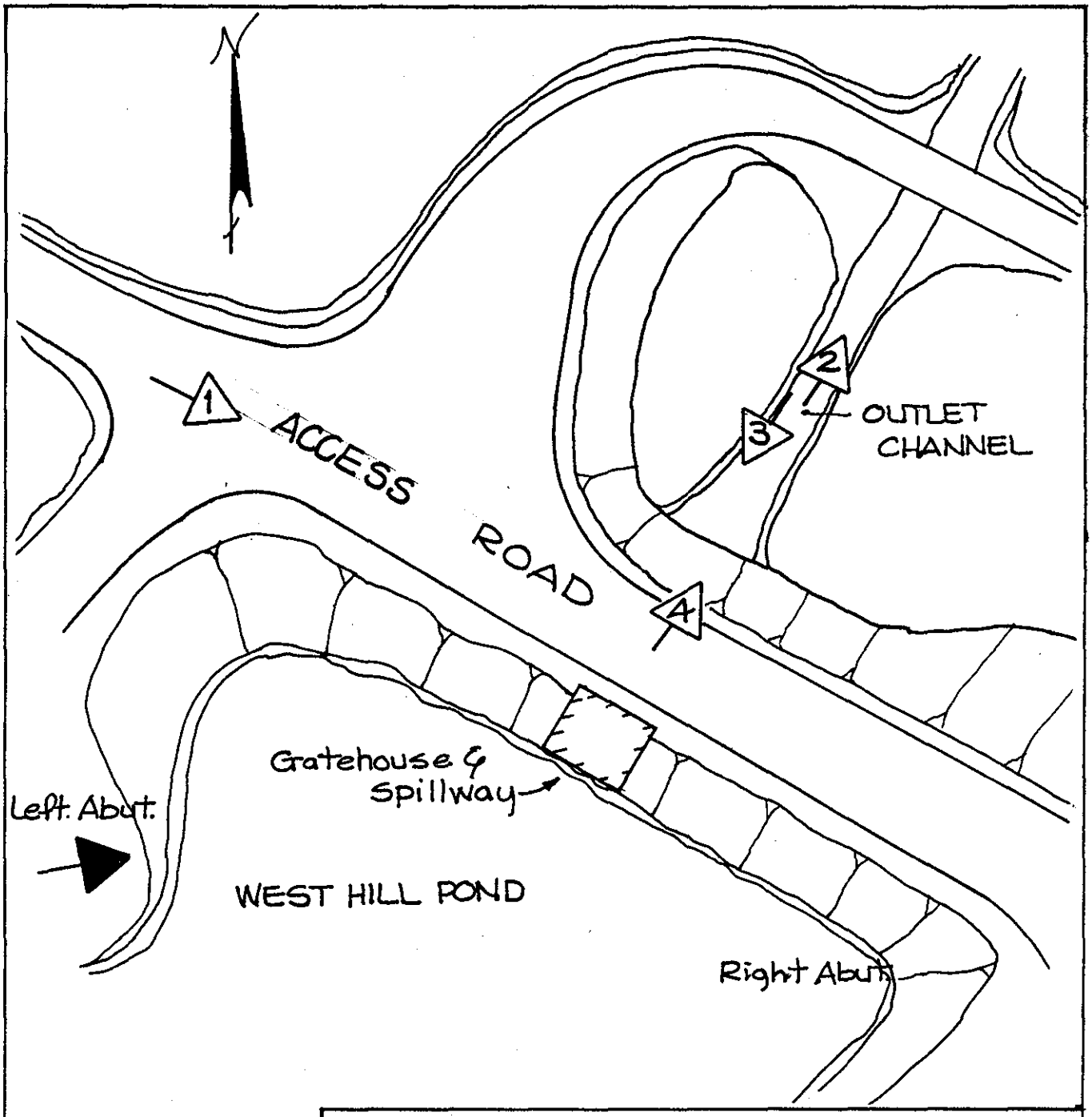
William H. O'Brien III
Civil Engineer

WHOIII:vhb

cc: Allyn Bernard,
New Hartford

APPENDIX C

SELECTED PHOTOGRAPHS



Appendix "C" Photos

Overview Photo

LOUIS BERGER & ASSOC., INC WELLESLEY, MASS. ARCHITECT · ENGINEER	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

WEST HILL LAKE DAM

SKETCH PLAN SHOWING LOCATION & ORIENTATION OF PHOTOS

STATE - CT.

			SCALE 1:24000
			DATE

WEST HILL POND DAM

1. Road over dam and gatehouse from left abutment.

2. Pipe culvert under local road about 300 ft. downstream from dam.

3. Outlet of masonry culvert under dam.

4. Morgan Brook immediately downstream from culvert headwall.

APPENDIX D

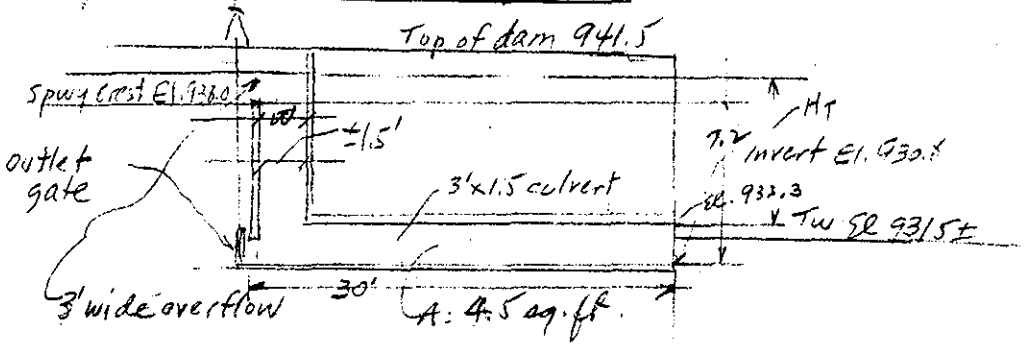
HYDROLOGIC & HYDRAULIC COMPUTATIONS

BY RJL DATE 12-14-78 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. D-1 OF...

CHKD. BY...DATE... INSPECTION OF DAMS Conn & RI PROJECT W 199

SUBJECT WEST HILL POND DAM #17

Spillway + outlet capacity



For crest flow over Spillway

El	H	$\frac{H}{W}$	C	L	$Q = CLH^{3/2}$
938	0				
939	1	0.67	3.0	3.0	9
940	2	1.33	1.5	3.0	13
941	3	2.0	1.0	3.0	16
942	4	2.7	0.8	3.0	19
944	6	4.0			

For full flow - control at outlet of spillway outfall

$Q = A\sqrt{\frac{2gH_T}{K_L}}$ $\quad Q = A\sqrt{\frac{2gH_T}{3}}$

$K_L = K_e + K_b + K_f + K_v$

$K_e = 0.5\ h_v$

$K_b = 3.5\ h_v$

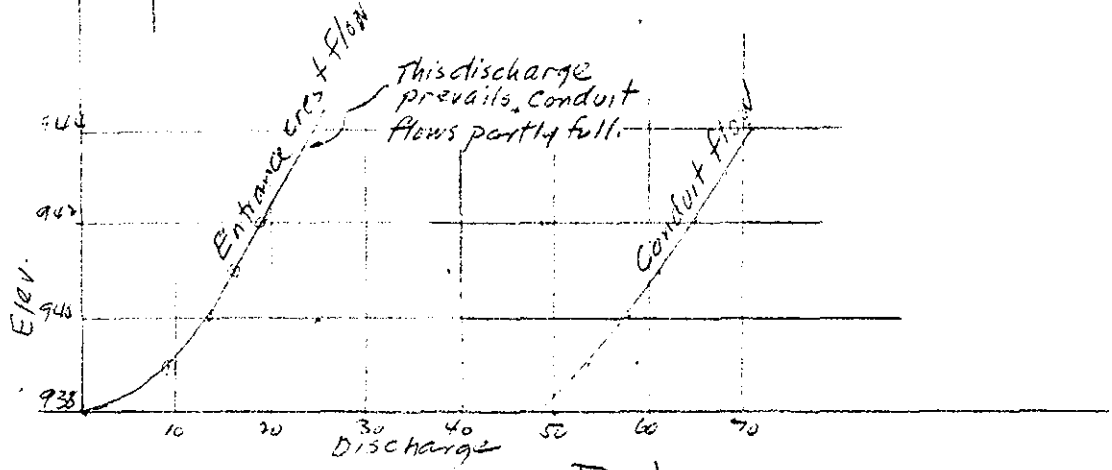
$K_f = \frac{fL}{D} = \frac{.024 \times 37'}{1.5} = 1.0\ h_v$

$K_v = 1.0\ h_v$

$K_L = 3\ h_v$

WS Elev	H_T	Q
932	0	0
939	6.7	54
940	7.7	58
941	8.7	61.5
941.5	9.2	63
942	9.7	65
943	10.7	68
944	11.7	71

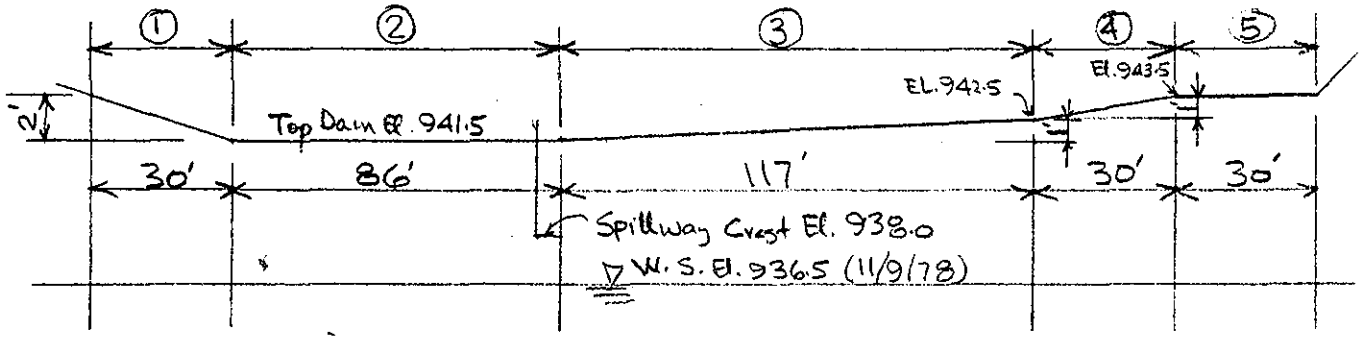
← This discharge will be approx. the same if flow is through outlet gate opening.



D-1

BY S.A.S DATE 12/14/78 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. D-2 OF.
CHKD. BY DATE WEST HILL POND DAM #17 PROJECT W 189
SUBJECT

DAM DISCHARGE



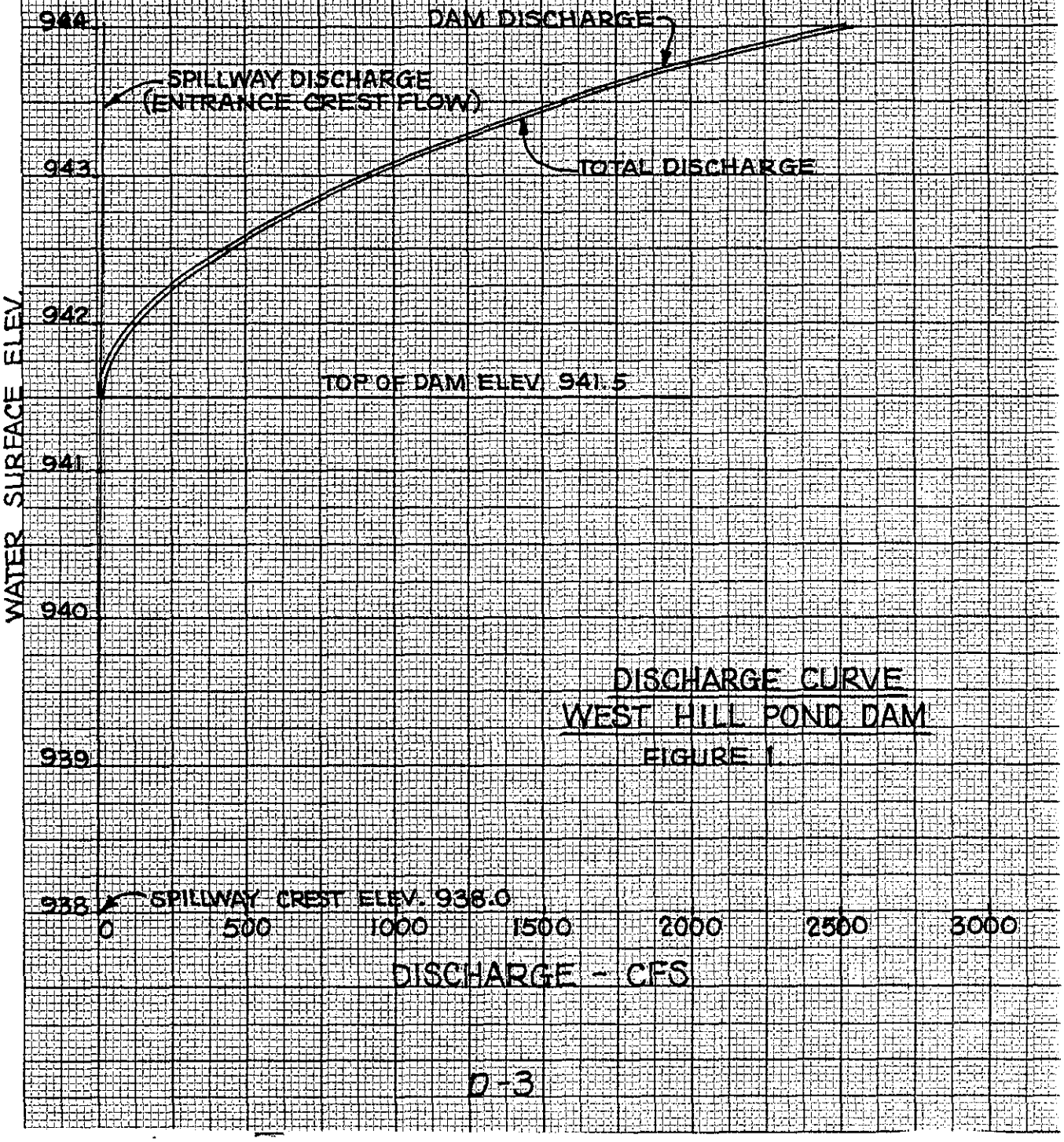
$Q = CLH^{3/2}$

SEC 2 — SEC. 1 (2' / 30')

ELEV.	H	C	L	q/ft.	ΔQ_2	C	L	Av. q/L	ΔQ_1
941.5	0	2.8	86	0	0	2.8		0	0
941.75	0.25	2.8	86	0.35	30	2.8	3.8	0.18	1
942.0	0.5	2.8	86	0.99	85	2.8	7.5	0.50	4
942.5	1.0	2.8	86	2.80	241	2.8	15.0	1.40	21
943.0	1.5	2.8	86	5.14	442	2.8	22.5	2.57	58
943.5	2.0	2.8	86	7.92	681	2.8	30.0	3.96	119
944.0	2.5	2.8	86	11.07	952	2.8	37.5	5.54	208

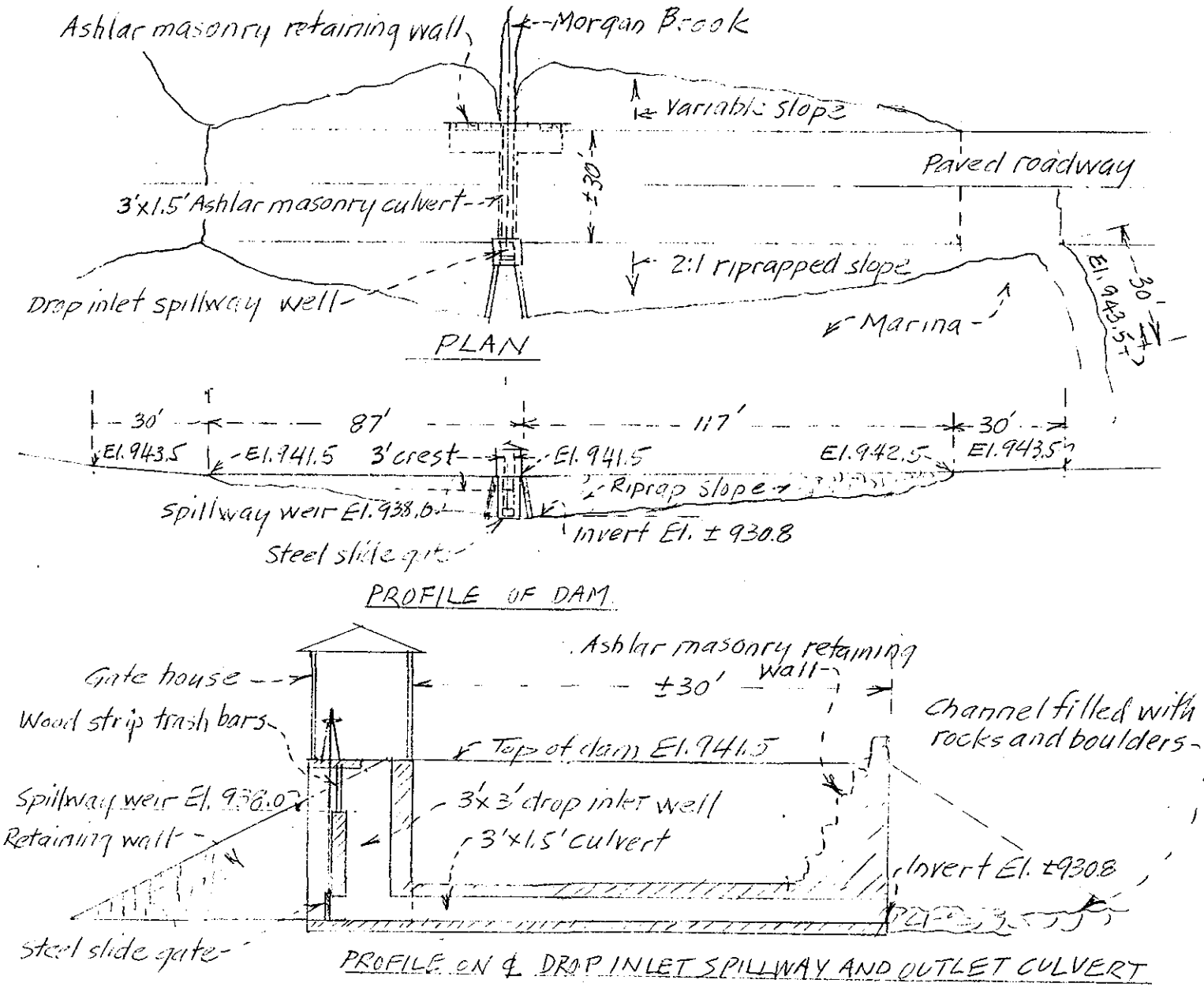
SECTION 3 — SEC. 4 — SEC. 5

ELEV.	q/Ft	Avg/ft	L	ΔQ_3	q/ft.	Av. q/ft.	L	ΔQ_4	q/ft.	Av q/ft	L	ΔQ_5	ΣQ
941.5	0	0			0				0				0
941.75	0.35	0.18	29.3	5	0.35				0.35				36
942	0.99	0.50	58.5	29	0.99				0.99				118
942.5	2.80	1.40	117	164	2.80	0			2.80				426
943	5.14	3.07	117	359	5.14	2.57	15	39	5.14				896
943.5	7.92	5.36	117	627	7.92	3.96	30	119	7.92	0			1,546
944	11.07	8.10	117	948	11.07	8.10	30	243	11.07	5.54	30	166	2,517



DISCHARGE CURVE
WEST HILL POND DAM
FIGURE 1.

K+E STANDARD ® CROSS SECTION
10 X 10 TO THE HALF INCH



WEST HILL POND DAM
PLAN AND SECTIONS

FIGURE 2 Sheet D-4

D-4

FIGURE 3
SHEET D-5

WEST HILL POND

NEW HARTFORD, CONN.

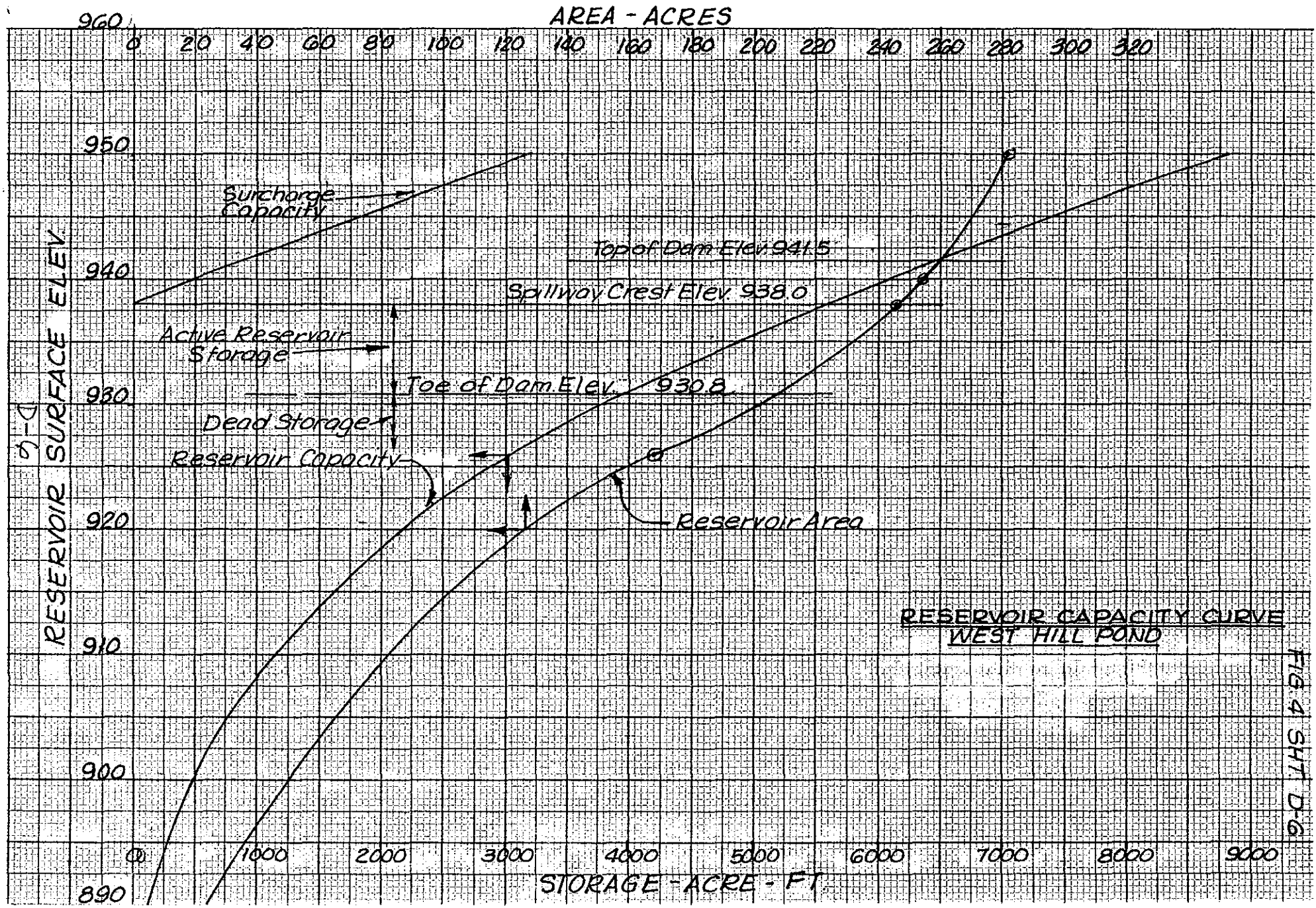
TRACED FROM AERIAL SURVEY MAP
238.26 ACRES PLANIMETER MEASUREMENT

CONTOUR INTERVAL
6 FEET

0 1 2 3

SCALE 1 = 600'

D-5



RESERVOIR CAPACITY CURVE
WEST HILL POND

FIG. 4 SHT. D-6

BY S.A.S DATE 12/14/78 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. D-7 OF.

CHKD. BY DATE WEST HILL POND RESERVOIR PROJECT W139

SUBJECT AREA-CAPACITY COMPUTATIONS

RESERVOIR CAPACITY CURVE

ELEV.	AREA (ACRE)	AV. AREA (ACRE)	HEIGHT (FT.)	INCREMENTAL STORAGE (ACRE-FT.)	CUMULATIVE STORAGE (ACRE-FT.)	SURCHARGE STORAGE (ACRE-FT.)	REMARKS
880	0						EL. 880: Area = 0
885	11	5.5	5	28	28		
890	24	17.5	5	88	116		
895	37	30.5	5	153	269		
900	50	43.5	5	218	487		
905	65	57.5	5	288	775		
910	83	74	5	370	1,145		
915	102	92.5	5	463	1,608		
920	126	114	5	570	2,178		
925	160	143	5	715	2,893		
930.8	207	183.5	5.8	1,064	3,957		El. 930.8 Toe of Dam
935	232	219.5	4.2	922	4,879		
938	246	239	3	717	5,596	0	El. 938.0 Spillway Crest
939	250	248	1	248	5,844	248	
940	254	252	1	252	6,096	500	
941	258	256	1	256	6,352	756	El. 941.5 Top of Dam
942	261	259.5	1	260	6,612	1,016	
943	265	263	1	263	6,875	1,279	
944	268	266.5	1	267	7,142	1,546	
945	270	269	1	269	7,411	1,815	
946	273	271.5	1	272	7,683	2,087	
947	275	274	1	274	7,957	2,361	
948	278	276.5	1	277	8,234	2,638	
949	280	279	1	279	8,513	2,917	
950	282	281	1	281	8,794	3,198	

Drainage Area (Total) = 1.16 sq. mi. = 742 Acres

Reservoir Area (West Hill Pond) = 0.38 " = 246 " at Elev. 938
= 33% of Total

∴ Overland Runoff = 0.78 = 496 "

Now, Length of longest watercourse, L = 5,000 ft = 0.95 mi.
(N.W. section of Watershed, to the pond)

& Elevation difference ; H = 1,070 - 938 = 132 ft

∴ Slope, $S = \frac{132}{0.95} = 139$ ft/mi (= 2.6%) & $\sqrt{S} = 11.79$

Now, $\frac{L.L_c}{\sqrt{S}} = \frac{(0.95)(0.95)}{(2)\sqrt{139}} = 0.038$

$$\left(\frac{L.L_c}{\sqrt{S}}\right)^{0.33} = (0.038)^{0.33} = 0.34$$

$$\text{Lag} = K\left(\frac{L.L_c}{\sqrt{S}}\right)^{0.33} = 0.34\,K$$

Assume, K = 1.4 Hrs (Refer to "Curve A", Mountainous Region, Foothill Type Terrain; Bureau of Reclamation)

∴ Lag = (0.34)(1.4) = 0.48 Hrs

Now, T_p = Time in hours from start of rise to peak rate

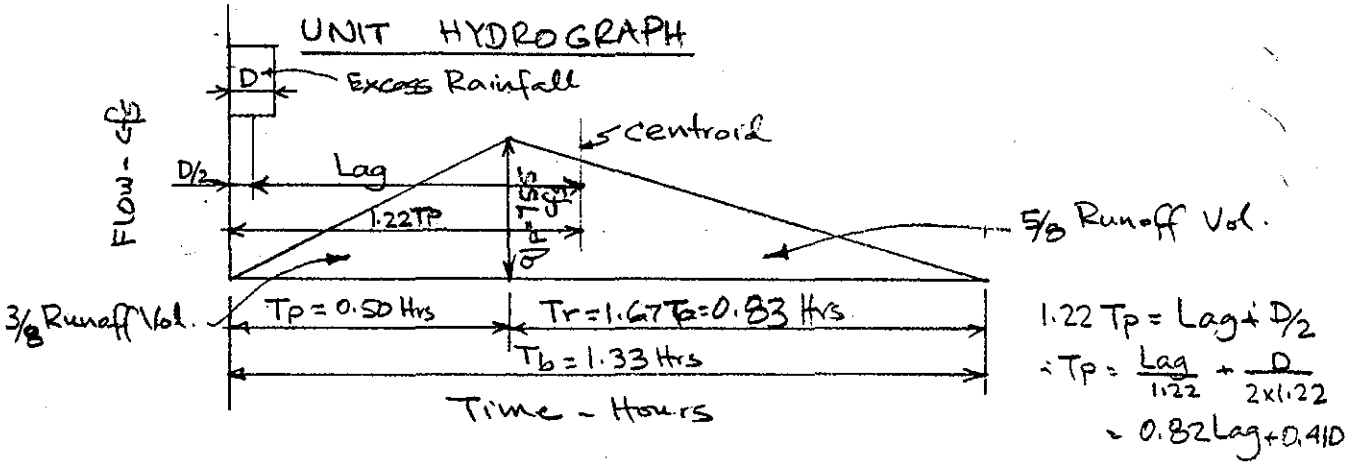
= 0.82 Lag + 0.41 D, where D = Rainfall excess period in hours

= (0.82)(0.48) + (0.41)(0.5) (Assuming D = 0.5 hrs.)

= 0.39 + 0.2 = 0.59 Hrs, Say T_p = 0.5 Hrs

D-8

Check for Velocity: $V = \frac{L}{\text{Lag} \times 3600} = \frac{5,050}{0.48 \times 3600} = 2.9$ fps (For S = 2.6%, Av. Vel. = 3% U.S. Navy Naudock TP-PW-5)



$1.22\,T_p = Lag + D/2$

$\therefore T_p = \frac{Lag}{1.22} + \frac{D}{2 \times 1.22}$

$= 0.82\,Lag + 0.41D$

q_p = Peak rate in cfs

$= \frac{484\,A \cdot Q}{T_p}$, where A = Drainage Area in Sq. mi
Q = Runoff in inches

$= \frac{(484)(0.78)(1.0)}{0.5}$

$= 755$ cfs

PMP = Probable Maximum Precipitation

$= (24'')(0.8) = 19.2$ inches for Connecticut

= 18.8 inches (considering infiltration) for Overland Runoff

Direct rainfall on the pond:

1 in/hr = 645.3 cu. ft./sec. per Sq. mi
$= (645.3)(0.38)$

$= 245$ cfs

$\therefore$ 1 in per $\frac{1}{2}$ hr $= (245)(2) = 490$ cfs

BY S.A.S DATE 12/13/78 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. D-10 OF

CHKD. BY DATE WEST HILL POND DAM PROJECT W189

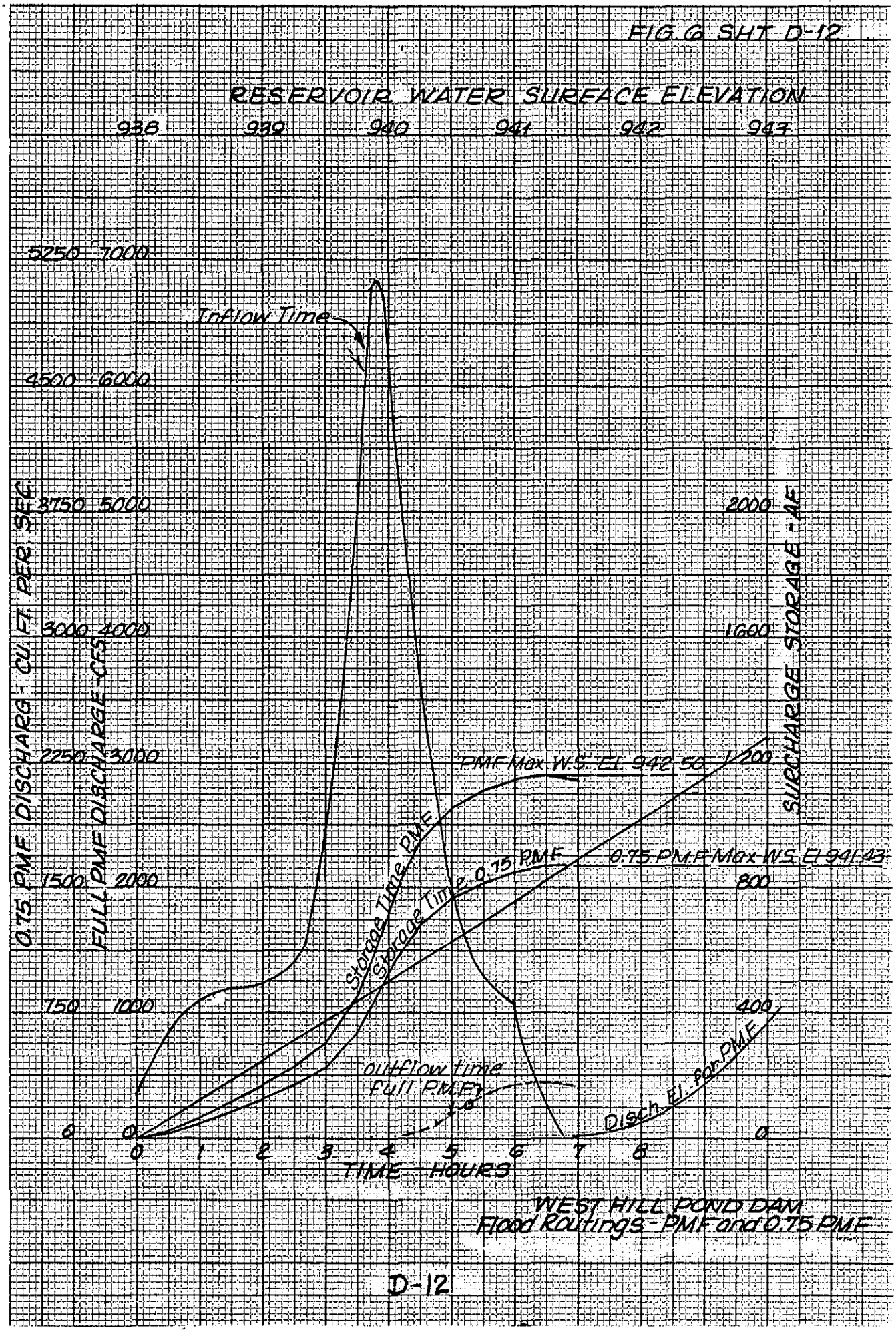
SUBJECT

FLOOD HYDROGRAPH — UNITGRAPH

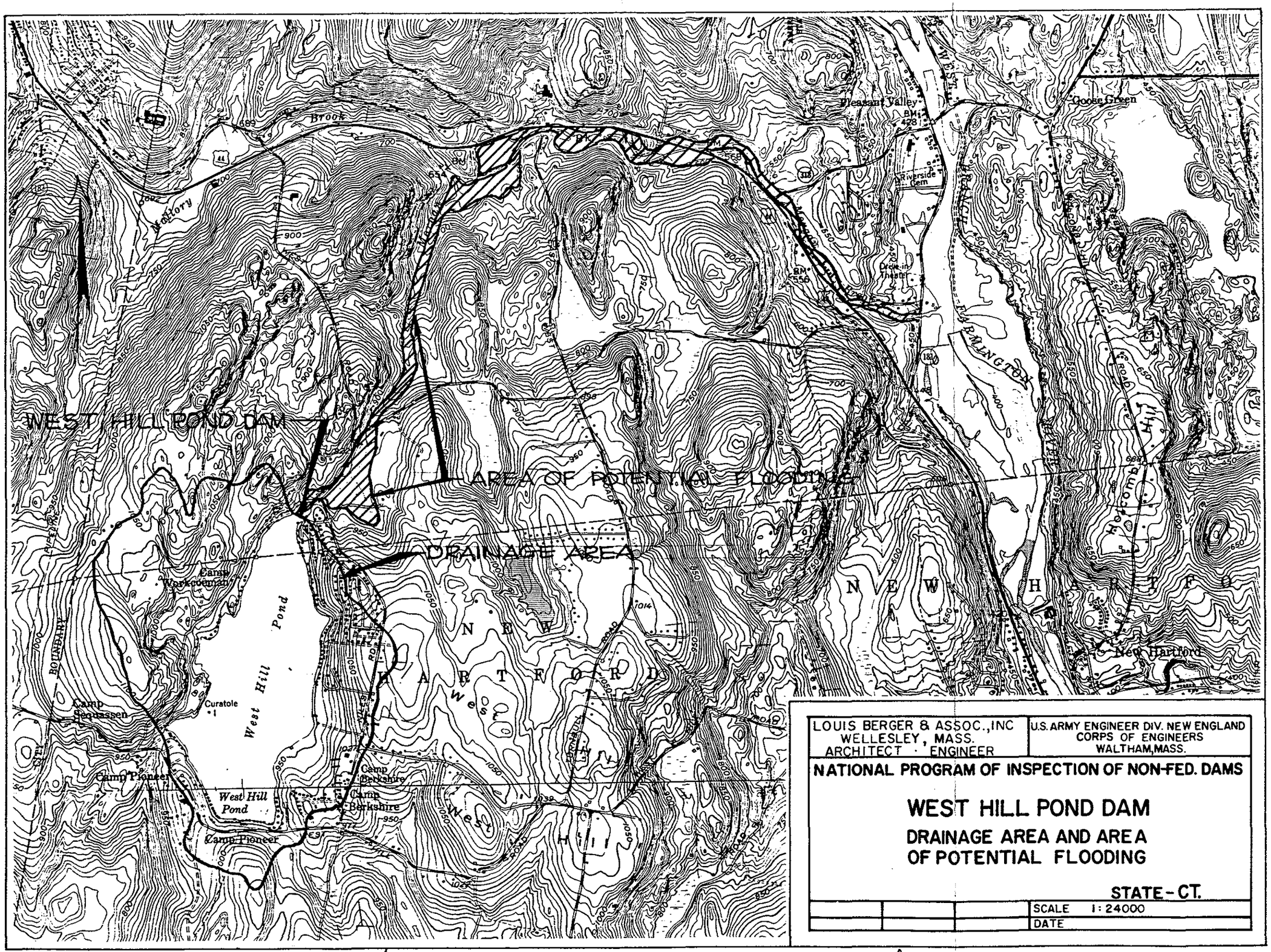
Time (Hours)	Excess Rainfall (Inches)	Overland Runoff — Incremental Hydrographs — Triangular				Rectangular Direct Rainfall on West Hill Pond (cfs)
		Peak Rate qp (cfs)	Begin Time	Peak Time	End Time	
0						
	0.75	566	0	0.5	1.33	368
0.5						
	0.75	566	0.5	1.0	1.83	368
1.0						
	0.75	566	1.0	1.5	2.33	368
1.5						
	0.75	566	1.5	2.0	2.83	368
2.0						
	0.94	710	2.0	2.5	3.33	461
2.5						
	1.13	853	2.5	3.0	3.83	554
3.0						
	3.57	2,695	3.0	3.5	4.33	1,749
3.5						
	5.64	4,258	3.5	4.0	4.83	2,764
4.0						
	1.69	1,276	4.0	4.5	5.33	828
4.5						
	1.32	997	4.5	5.0	5.83	647
5.0						
	0.75	566	5.0	5.5	6.33	368
5.5						
	0.75	566	5.5	6.0	6.83	368
6.0						

Total 18.79" 14,185 cfs 9211 cfs

FIG 6 SHT D-12



WEST HILL POND DAM
Flood Routings - PMF and 0.75 PMF



LOUIS BERGER & ASSOC., INC WELLESLEY, MASS. ARCHITECT · ENGINEER	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

WEST HILL POND DAM

DRAINAGE AREA AND AREA OF POTENTIAL FLOODING

STATE - CT.

			SCALE 1:24000
			DATE

FIGURE 7, D-13

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

(1) STATE	(2) IDENTITY NUMBER	(7) DIVISION	(3) STATE	(4) COUNTY	(5) CONGR DIST.	(6) STATE	(7) COUNTY	(8) CONGR DIST.	(9) NAME	(10) LATITUDE (NORTH)	(11) LONGITUDE (WEST)	(12) REPORT DATE DAY	MO	YR
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				WEST HILL POND DAM	4153.0	7302.0	17	JA	79

(13) POPULAR NAME	(14) NAME OF IMPOUNDMENT
	WEST HILL POND

(15) REGION	(16) BASIN	(17) RIVER OR STREAM	(18) NEAREST DOWNSTREAM CITY–TOWN–VILLAGE	(19) DIST FROM DAM (MI.)	(20) POPULATION
[illegible]	[illegible]	MORGAN BROOK	HARKNAMPSTED	1	5000

(21) TYPE OF DAM	(22) YEAR COMPLETED	(23) PURPOSES	(24) STRUCTURAL HEIGHT (FT.)	(25) HYDRAULIC HEIGHT (FT.)	(26) IMPOUNDING CAPACITIES MAXIMUM (ACRE–FT.)	(27) NORMAL (ACRE–FT.)	DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
EARTH	1900	R	11	11	2525	1680	NFD	N	N	N	N	21FEB79

(28) REMARKS
ESTIMATE

(29) D/S HAS	(30) SPILLWAY CREST LENGTH	(31) TYPE	(32) WIDTH (FT.)	(33) MAXIMUM DISCHARGE (FT.)	(34) VOLUME OF DAM (CY)	(35) POWER CAPACITY INSTALLED (MW)	(36) PROPOSED (MW)	(37) NO.	(38) LENGTH (FT.)	(39) WIDTH (FT.)	(40) LENGTH (FT.)	(41) WIDTH (FT.)	(42) LENGTH (FT.)	(43) WIDTH (FT.)	(44) LENGTH (FT.)	(45) WIDTH (FT.)
[illegible]	[illegible]	[illegible]	3	[illegible]	5650											

(46) OWNER	(47) ENGINEERING BY	(48) CONSTRUCTION BY
WEST HILL [illegible]		

(49) REGULATORY AGENCY DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
[illegible]	NONE	NONE	NONE

(50) INSPECTION BY	(51) INSPECTION DATE DAY	MO	YR	(52) AUTHORITY FOR INSPECTION
LOUIS BERGER & ASSOCIATES, INC.	19	[illegible]	78	PL92-367

(53) REMARKS